Transboundary Monitoring Network

Estevan, Saskatchewan–Burke County, North Dakota

1999–2000 Report

Canada – United States

Transboundary Monitoring Network

Estevan, Sakatchewan–Burke County, North Dakota

1999–2000 Report

July 2002

Executive Summary

In response to concerns expressed by the United States about possible transboundary air pollution and in keeping with the United States–Canada Air Quality Agreement, representatives from both countries began working together to investigate these concerns and to identify potential solutions. Members of the Saskatchewan–North Dakota Transboundary Monitoring Group designed and put in place a fully operational monitoring network.

The purpose of the network is to characterize the transboundary flow of particulate matter (PM) and precursor gases, and to monitor changes in the air quality over time. The network consists of five sites jointly operated by SaskPower, Sask Water, and the North Dakota Department of Health (NDDH).

The Boundary Dam Power Station (BDPS), Short Creek, and Lignite sites were operational and collecting data by the end of 1999. During 2000, the Estevan and Rafferty Dam sites became operational and began collecting data. The data is reported quarterly by the NDDH and is added to the United States Environmental Protection Agency (USEPA) AIRS-AQS database and the Canadian NatChem database.

Examination of the 1999–2000 data showed that no air quality standards were exceeded at any of the sites.

Data from the BDPS site is not included in this report. Analysis of the data from this site revealed that the location is best suited as a source-specific site; therefore the data from the BDPS site cannot be compared to results obtained at the other transboundary monitoring sites. Data from this site will be presented in a future report.

The detailed Quality Assurance Project Plan (QAPP) for the network was not completed in 1999-2000. There are a number of regional differences that must still be identified and understood. Work is ongoing to come to a consensus on the plan. In the interim, the network is following the NDDH USEPA-approved QAPPs.

A public meeting took place in Lignite, North Dakota on June 16, 2000. Concerned citizens had the opportunity to obtain information from members of the Monitoring Group and ask questions about the air and water quality in the transboundary region.

[1] American spelling is used throughout. Future reports will alternate the use of Canadian and American spelling.

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List of Abbreviations and Acronyms

AIRS-AQS – Aerometric Information Retrieval System-Air Quality Subsystem

BDPS – Boundary Dam Power Station

CFR – Code of Federal Regulations

EC – Environment Canada

EDRF – energy dispersive x-rays fluorescence

ESP – electrostatic precipitator

ETC – Environmental Technology Centre

FRM – Federal Reference Method

MDV – Minimum Detectable Value

NDDH – North Dakota Department of Health

PM – particulate matter

PM10 – nominally, particles with aerodynamic diameters less than or equal to 10 µm

PM2.5 – nominally, particles with aerodynamic diameters less than or equal to 2.5 µm

QA/QC – quality assurance/quality control

QAPP – Quality Assurance Project Plan

SPM – special purpose monitor

TBN – transboundary network

TSP – total suspended particulate

TEOM – tapered element oscillating microbalance

USEPA – United States Environmental Protection Agency

WS – wind speed

WD – wind direction

1 Introduction

The North Dakota Department of Health (NDDH) has received complaints about poor air quality in Burke County. These complaints have ranged from particles reducing visibility to health-related concerns. The Boundary Dam Power Station (BDPS) outside Estevan, Saskatchewan is perceived to be the major source of the particles in this area; however, cars, farm vehicles, coal mining, agricultural dust and other industrial facilities are also contributors to the poor air quality problem.

Canada and the United States are committed to addressing shared concerns regarding transboundary air pollution under the 1991 United States–Canada Air Quality Agreement[2]. Article XI of the Agreement allows for binational consultation when a transboundary concern is raised. In 1997, the United States requested that binational discussions be undertaken on the Boundary Dam Power Station and the possible contribution to transboundary air pollution. The Saskatchewan–North Dakota Transboundary Consultation Group was established following the four guidelines of the consultation process (Appendix 1). These guidelines were adopted by the United States–Canada Air Quality Committee to help guide consultations such as this under the Agreement.

The Consultation Group is responsible for investigating the transboundary problem of concern and identifying solutions. Bringing interested parties together for discussion, action, and publication of air quality information for this region, the member organizations of the Consultation Group are detailed in Appendix 2.

[2] The United States–Canada Air Quality Agreement is available at: http://www.epa.gov.airmarkets/usca/agreement/html The Canada–United States Air Quality Agreement is available at: http://www.ec.gc.ca/pdb/can_us/canus_links_e.cfm

Since 1998, much information has been exchanged on the sources of pollution in the transboundary region. Although the BDPS is the most conspicuous, there are a number of other emission sources in the area that may be contributing to poor visibility and health effects, and triggering the complaints. A smaller Monitoring Group, therefore, was established to characterize the transboundary air pollution in the Estevan-Burke County Region. The Monitoring Group developed a plan to establish an ambient air quality monitoring network for collecting measurements of fine particle mass, precursor gases, and meteorology at locations upwind and downwind of the area.

SaskPower, the operator of BDPS (Figure 1), is installing electrostatic precipitators (ESPs) on the stacks at the power station over a five-year period beginning in October 1999. Commissioning tests indicate that the ESPs remove about 99.8% of the particles. By the end of 2000, two 150 MW units had ESP's installed and operational. A third ESP was contracted for installation on a 150 MW unit in 2001.

Installation of ESPs on the power station will allow the monitoring network to track changes in air quality before and after the complete installation of this control technology. The data collected, therefore, will have a number of uses:

1. characterizing transboundary air flows,
2. establishing current air quality conditions,
3. characterizing air pollution concentrations before and after new control equipment is installed, and
4. as information for other agencies possibly doing health effects studies in the future.

The Air Quality Agreement Consultation Guidelines recommend holding meetings to discuss and exchange information, and to collect and analyze regionally relevant and scientifically sound data.

The Guidelines also identify public reporting and information exchange as key deliverables. This 1999–2000 report is the first document that reports data from the network and provides feedback to concerned citizens. It will be followed by future reports as results from the monitoring network and consultation are achieved.

2 Description of the Region and Monitoring Sites

The primary study area is the region within 12.5 miles (20 kilometres) of Estevan upwind and about 37.5 mi (60 km) downwind, southeast of Estevan. The combined population in the area is approximately 13 000 people.

Two major power plants, BDPS and Shand, are located in the Canadian portion of the region. Sources in North Dakota that may have an impact on air quality in the area are the coal conversion facilities in Mercer, Oliver, and McLean Counties and the gas processing plants in the northwestern part of the state. Other particle sources in the region include: a coal carbonizing plant, coal mines, oil and gas production, agricultural activities, grid roads, heavy-duty diesel vehicles, and flaring in the Saskatchewan oil fields.

The five monitoring sites are located on the map of the Souris River Basin in Figure 2.

The Rafferty Dam site is approximately 6.25 mi (10 km) west-northwest of Estevan in the Saskatchewan Water Corporation (Sask Water) operations complex for the dam. The sampler is located on the east side of the complex with a direct line-of-sight down the river valley to BDPS and a limited view of the Shand Power Station, approximately 14 mi (23 km) to the east-southeast. The Estevan site is located in the south central part of town. The BDPS site is located on plant property, less than one-mile (approximately 100 m) southeast of the power station, 3 mi (5 km) south-southwest of Estevan. The Short Creek site is located in the Short Creek Wildlife Management Refuge, approximately 14 mi (23 km) southeast of Estevan. The Lignite site is located on the west side of town, approximately 27 mi (43 km) southeast of Estevan.

3 Activities and Progress 1999–2000

3.1 Monitoring Plan

The Monitoring Group developed and implemented a monitoring plan with the following goals:

1. to characterize transboundary flows of PM and precursor gases,
2. to establish current levels and monitor changes over time,
3. to develop a QAPP, and
4. to develop a common data reporting format.

To characterize transboundary flows of particles, the monitoring network focuses on ambient air pollutants: PM2.5, sulfur dioxide (SO_2), nitrogen oxides (NO_X), and meteorology, including wind speed, wind direction, and temperature. The five monitoring sites, shown in Figure 2, make up the ambient monitoring network. Sites at Lignite, the BDPS, and Short Creek, were operational in 1999. During 2000 the Estevan and Rafferty Dam sites became operational. Table 1 identifies the sites, operating agencies, the parameters being measured, start dates, and sampling frequency.

As indicated in Table 1, PM2.5 (24-h sample every 6th day) is measured at all five sites. The PM2.5 FRM at Estevan is shown on the front cover. Continuous PM2.5 measurements occur at Estevan and Short Creek. The continuous PM2.5 sampler inside the Estevan trailer is shown in Figure 3. Figure 4 shows the setup at Short Creek.

PM10 (24-h sample every 6th day) is measured at Short Creek and BDPS. Co-located[3] PM samplers at Lignite are shown on the front cover. Total suspended particulate is measured at BDPS.

Because there are no long-term monitoring data in the region, the 1999 data will be used to establish baseline concentrations. Environment Canada (EC) monitors climate data at Estevan. Since there were no excursions of any standards during the reporting period, the climate data were not included in this report.

As part of the monitoring plan, speciation data collected at some sites outside the region may be used to supplement the data collected at the five primary sites. An IMPROVE sampler, which began operating January 1, 2000, was installed by the USEPA Fish and Wildlife Service in the Lostwood National Wildlife Refuge, 70 km southeast of Estevan. Environment Canada, Meteorological Services of Canada operates prairie background sites at Bratt's Lake, 50 km south of Regina and Esther, southeast of Calgary, close to the Alberta/Saskatchewan border. Precipitation chemistry, oxidants, PM10, PM2.5, full metal speciation, haze and visibility sampling will continue at Esther until 2003[4] and commence at Bratt's Lake in 1999. The additional speciated data will enable source apportionment modeling in the future.

In addition to collecting monitoring data, all partners agreed to record complaints from citizens in the area including the nature of the complaint, date and time of events triggering the complaint, and observations of meteorological conditions at the time of the event. These data will be exchanged between the Monitoring Group members by means of electronic spreadsheets (EXCEL 97). In 1999–2000 there were no complaints received by any of the participating agencies.

[3] Co-located samplers are two identical samplers set up side-by-side for quality control purposes.

[4] In 2003, Esther will be decommissioned or turned over to provincial agencies.

The network will operate for at least five calendar years, after which the Monitoring Group will make a recommendation to the Consultation Group concerning future monitoring needs in the area.

3.2 Quality Assurance Project Plan

A secondary objective of the Monitoring Plan was to develop a QAPP which would be in place for the duration of the monitoring project to ensure that the data produced are of acceptable precision, accuracy, completeness, and comparability, and are representative.

A draft PM2.5 QAPP has been prepared and will be signed by all parties: SaskPower, Saskatchewan Environment (SE), NDDH, EC, and the USEPA. It is based on the Model Quality Assurance Project Plan for PM 2.5 Ambient Air Monitoring Program for State and Local Air Monitoring Stations (EPA-454/R-98-005, April 1998). Differences in minimum quality assurance/quality control (QA/QC) requirements between the USEPA, EC, and SE, however, may limit the ability to compare data collected from all sites. Two specific problems are the procedures used at BDPS site for processing both the PM10 and PM2.5 filters, and the operating temperature for the continuous PM2.5 analyzers (TEOM) at both Estevan and Short Creek. In the interim, network operations are according to the USEPA-approved NDDH PM2.5 QAPP.

There have been several holdups in the development of QAPP for the other parameters including: 1) data reporting procedures and format; and 2) availability of QA/QC information from all participating agencies. Discussions are ongoing; therefore, the USEPA-approved NDDH QAPP is currently used for the continuous data.

As part of the QAPP, the operating agencies are each responsible for sample collection and site Reference Methods at Rafferty Dam, Estevan, Short Creek, and Lignite. SE trained the TEOM operators. The PM2.5 filters for all sites, except BDPS, will be shipped to North Dakota's contract laboratory for gross mass weighing. The NDDH

will store the filters for potential future speciation analysis.

Quality assurance and quality control activities will be shared jointly with all parties. All samplers need performance audits and calibration every six months. Flow verification checks occur at least once every three months.

The NDDH will audit and calibrate the sites in Burke County, and the PM2.5 FRM at Estevan and Rafferty Dam. SaskPower will audit and calibrate the samplers at the BDPS site and the remaining parameters at Estevan. Comprehensive performance audits will begin in 2001. SE will audit all five sites in 2001, after which the responsibility, and costs, will alternate between SE and the NDDH.

3.3 Data Management and Accessibility

The QAPP describes the requirements for ensuring data are provided in a timely manner using a common data reporting format that the two countries can integrate into their air quality databases. All manual and continuous data collected will be submitted to the NDDH within 90 days after the end of the quarter. Technicalities have precluded including the data collected at BDPS site and in Estevan in the quarterly reports.

The NDDH produces quarterly data summaries for distribution to Consultation Group members. Data that has been included in the quarterly reports is provided to the EPA AIRS by the NDDH. The data can be downloaded through the EPA AIRS Web page at http://www.epa.gov.airs/ for North Dakota, Burke County. Particle data are also provided annually to the National Atmospheric Chemistry Database (NatChem). NatChem is a data archival and analysis facility operated by the Meteorological Service of Canada. The Web site is http://www.smc.ec.gc.ca/natchem/particles/nettable_e.html, and the Network is "Transboundary Monitoring Network" or TNDM. To date, data sharing technicalities have precluded the inclusion of data collected by SaskPower at BDPS and Estevan.

3.4 Regional Emissions Inventory

The Consultation Group agreed to collect information on the emissions of all sources in the area. Combined with speciation data, the emissions information could be used to identify which specific sources are affecting transboundary air quality.

Point sources of emissions of greater than 100 tons (90 tonnes) and within a 60-mile (100 km) radius of Estevan were inventoried (Appendix 3). PM10 and PM2.5 were calculated from Total Suspended Particulate (TSP) for the SaskPower Stations. The Boundary Dam Power Station was the largest single source regional emitter of SO_2, NO_2, PM2.5, and PM10. The only point source of carbon monoxide (CO) identified was Bear Paw Energy-Alexander Compressor Station in the United States.

3.5 Community Outreach

The Monitoring Group hosted an open house in Lignite in June 2000. Approximately 35 community members attended and had the opportunity to read posters and pick up material on the BDPS, North Dakota air quality programs, and the United States–Canada Air Quality Agreement (see Figure 5). A USEPA Federal Reference Method PM2.5 sampler was also on display.

The information meeting began with several presentations on air quality programs and health research in North Dakota, air quality programs in Saskatchewan, and environmental stewardship at the BDPS. Participants then asked questions about the various programs, operations, and potential impacts of local air and water quality. No health scientists were present to provide information on any health risks and related health effects in the area.

4 Air Quality Monitoring Results and Discussion

There were a number of quality assurance issues regarding operation of the SO_2, NO_2, and particle analyzers at Estevan, SK during the period covered by this report. Therefore, the data from 1999 and 2000 are not included in this report. A performance audit carried out in late 2001 found a number of operational and procedural irregularities. The decision to exclude the information from this report was made to allow time to assess the validity of data. An evaluation of the potential problems, and resolutions will be included in future reports. If the data can be shown to meet the requirements of the data quality objectives, it too, will be included in future reports.

Based on the 1999 and 2000 results from the monitoring stations in the network, there were no exceedances of the Saskatchewan, ND State, Canada-Wide Standards or US federal standards in 1999 or 2000. The levels of the air quality standards and monitoring data are detailed in Appendix 4.

4.1 PM2.5 Data

In 2000, the maximum 24-h concentration measured with the continuous TEOM analyzer was 14.8 µg/m^3 on October 12 at Short Creek. An 80% data recovery was achieved for the period operated.

At the FRM samplers, the maximum 24-h concentration was 21.8 µg/m^3 on October 27, 1999 at Short Creek. In Lignite in 1999, the maximum 24-h concentration was 8.1µg/m^3 on August 11. In 2000, the maximum 24-h concentration ranged from 12.8 µg/m^3 on April 4 in Lignite to 13.9 µg/m^3 on November 23 and August 4 measured at Estevan and Rafferty Dam, respectively (Figure 6). In 1999, the maximum annual average concentration was 6.2 µg/m^3 at Short Creek and 4.6 µg/m^3 at Lignite. In 2000, the maximum annual average concentration ranged from 8.7 µg/m^3 at Estevan to 5.8 µg/m^3 at Short Creek (Figure 7). An 80% data recovery was achieved for the period operated for all stations except Estevan, SK. Estevan station had some problems with start-up that have since been resolved.

4.2 Other Data–Short Creek

Sulfur Dioxide (SO_2)
The maximum 1-h concentrations were 52 ppb on October 25 1999 and 149 ppb on May 30, 2000 (Figure 8). The maximum 24-h concentrations were 10 ppb on May 17, 1999 and 16 ppb on May 30, 2000 (Figure 9). The annual arithmetic mean concentrations were 1.9 ppb in 1999 and 2.1 ppb in 2000 (Figure 10). An 80% data recovery was achieved for the period operated.

In 1999, the hourly maximum 5-min. average SO_2 concentration was 172 ppb on March 1. In 2000, the hourly maximum 5-min. average concentration on May 30 was 381 ppb.

Nitrogen Dioxide (NO_2)
The maximum 1-h concentration observed was 24 ppb on December 27, 1999 and November 29, 2000 (Figure 11). The average annual concentration at the same site was 2.6 and 3.0 ppb in 1999 and 2000, respectively (Figure 12). An 80% data recovery was achieved for the period operated.

PM10
The maximum 24-h concentration was 52.1 µg/m^3 on August 4, 1999 and 54.3 µg/m^3 on May 30, 2000 (Figure 13). The maximum annual average concentrations at Short Creek were 17 µg/m^3 and 19.6 µg/m^3, in 1999 and 2000, respectively (Figure 14). An 80% data recovery was achieved for the period operated.

Sulfate Particles
In 1999, the maximum 24-h concentration was 5.7 µg/m^3 on April 30. In 2000, the maximum 24-h concentration was 3.3 µg/m^3 on March 7. An 80% data recovery was achieved for the period operated.

4.3 Boundary Dam Power Station, SK

Data from the BDPS is not included in the report. The site is located on plant property, southeast of

the power station. There are frequent excursions of local air quality standards at this site that appear to be due to the proximity of the power station. This raises questions about the suitability of including this site in an ambient air monitoring network. The present location may be best suited to assess the local impact of the particle controls at the power station. SaskPower is interested in retaining this site-specific information; therefore, an option may be to move the monitoring equipment to another, more representative, location after the upgrades at the power stations are completed.

5 Conclusions and Next Steps

1. No excursions of air quality standards were recorded in 1999–2000 at the Estevan, Short Creek, Lignite, or Rafferty Dam sites.

2. The location of BDPS is unsuitable for inclusion in an ambient air quality network. The site and data should be examined closely to determine if the data could provide additional site-specific information that may assist in the interpretation of the transboundary monitoring network.

3. There are issues related to the quality assurance methods for the network that have caused some data to appear questionable. Questionable data have not been included in this report. The Monitoring Group will continue working to resolve outstanding quality assurance issues.

4. If warranted, future reports may examine possible impacts of meteorological conditions on the concentration of air pollutants detected at the network sites.

Table and Figures

Table 1 Estevan, SK–Burke County, ND Transboundary Monitoring Network Sites

Site	Location	Operating Agency	Parameters	Start Date	Operating Schedule
Boundary Dam Power Station	Saskatchewan, 100 m southeast of the Power Station, 5 km south-southwest of Estevan	SaskPower	SO_2 NO_2 PM2.5 FRM PM10 FRM TSP WS, WD	4 Feb 00 4 Feb 00 Nov 98 Nov 98 Nov 98 Nov 98	Continuous Continuous 1/6 day 1/6 day 1/6 day Continuous
Estevan	Saskatchewan	SaskPower	SO_2 NO_2 PM2.5 TEOM PM2.5 FRM WS, WD, Temp	1 Aug 92 1 Aug 92 30 Mar 00 23 Nov 00	Continuous Continuous Continuous 1/6 day
Short Creek	Burke County, ND, 11 km north of Columbus, 23 km southeast of Estevan	NDDH	SO_2 NO_2 PM2.5 TEOM PM2.5 FRM PM10 FRM WS,WD,Temp	1 Mar 99 1 Mar 99 1 Sep 00 13 Dec 98 8 Sep 98 1 Mar 98	Continuous Continuous Continuous 1/6 day 1/6 day Continuous
Lignite	Burke County, ND, 43 km southeast of Estevan	NDDH	PM2.5 FRM	1 Apr 99	1/6 day
Rafferty Dam	Saskatchewan, 10 km west northwest of Estevan	Sask Water	PM2.5 FRM	1 Apr 00	1/6 day

Figure 1 Boundary Dam Power Station

Figure 2 Location of the Five Monitoring Sites

Figure 3 Continuous PM2.5 Sampler (TEOM) Inside the Shelter at Estevan

Figure 4 FRM and Trailler Sheltering Additional Equipement at Short Creek

Figure 5 Members of the Public Reading Posters During the Open House

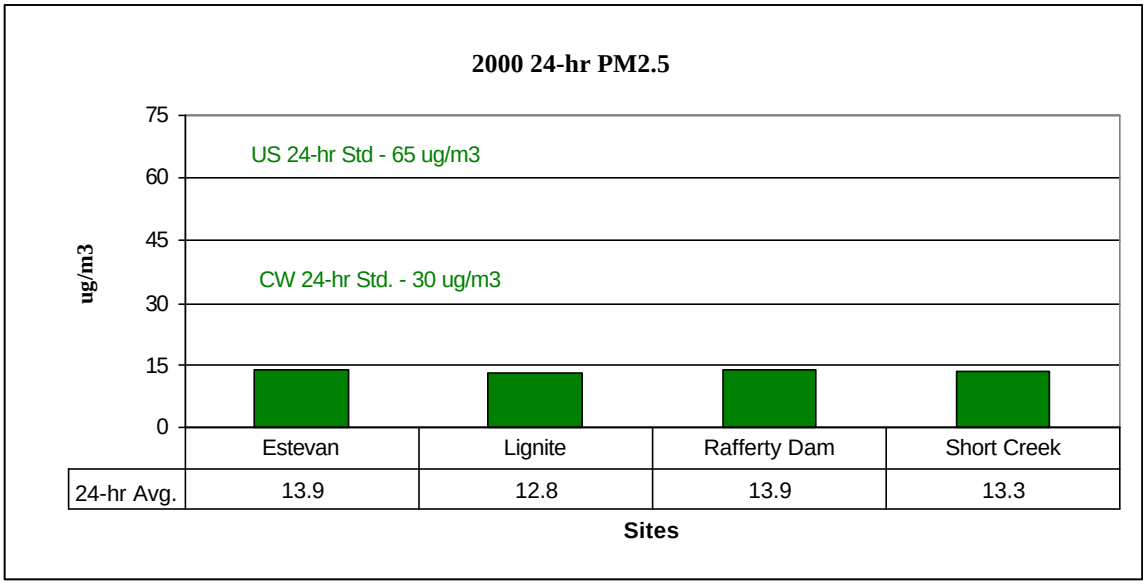

Figure 6 Maximum 24-h Concentration of PM2.5 in 2000

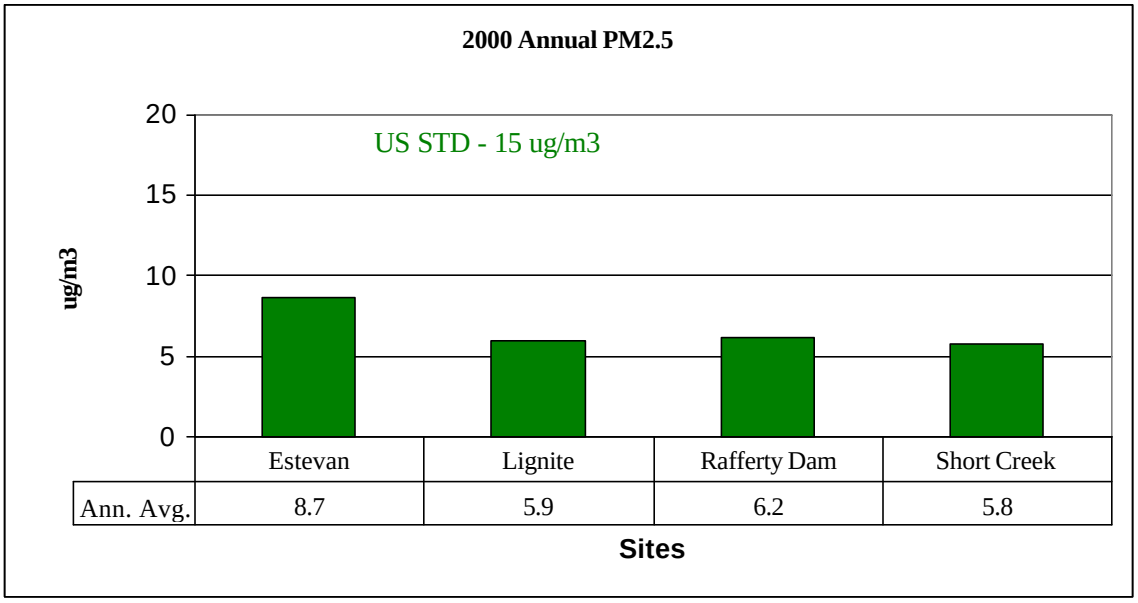

Figure 7 Annual Average 24-h Concentration of PM2.5 in 2000

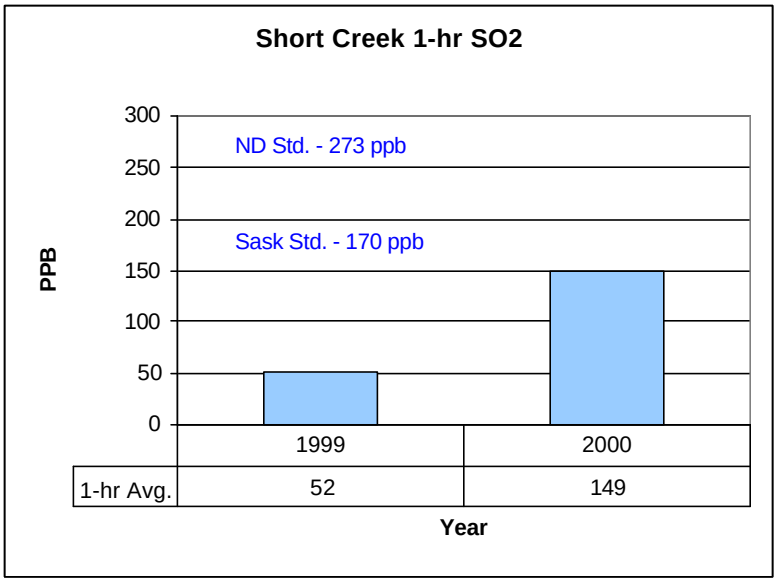

Figure 8 Maximum 1-h Concentration of Sulfur Dioxide at Short Creek, 1999-2000

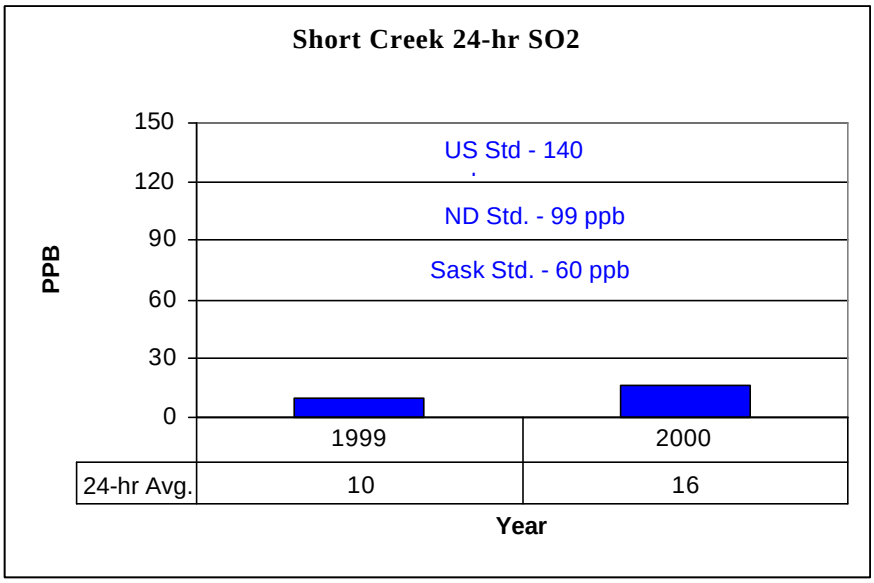

Figure 9 Maximum 24-h Concentration of Sulfur Dioxide at Short Creek, 1999-2000

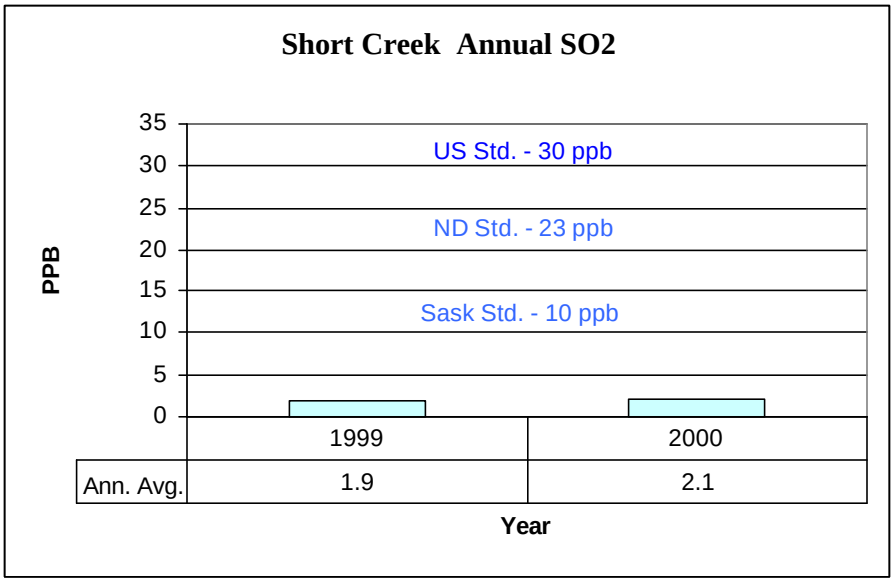

Figure 10 Annual Average Concentration of Sulfur Dioxide at Short Creek, 1999-2000

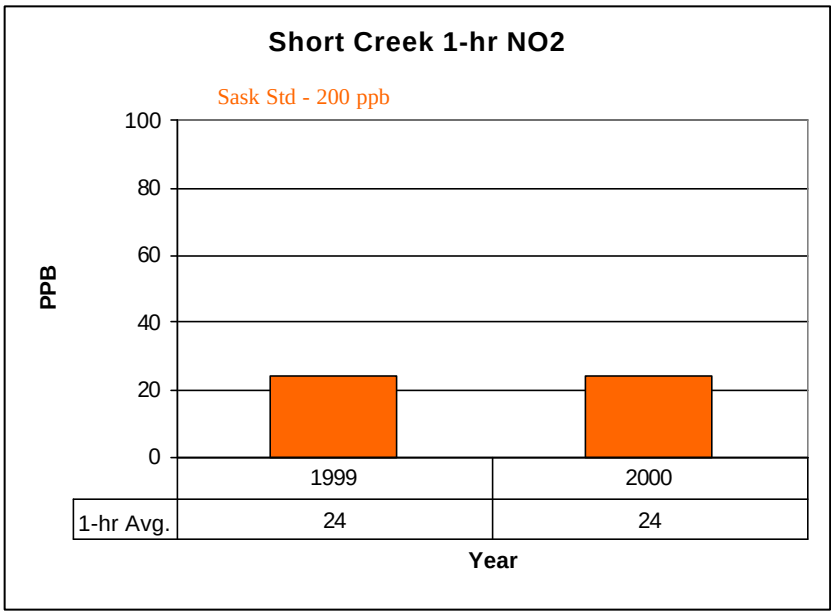

Figure 11 Maximum 1-h concentration of Nitrogen Dioxide at Short Creek, 1999-2000

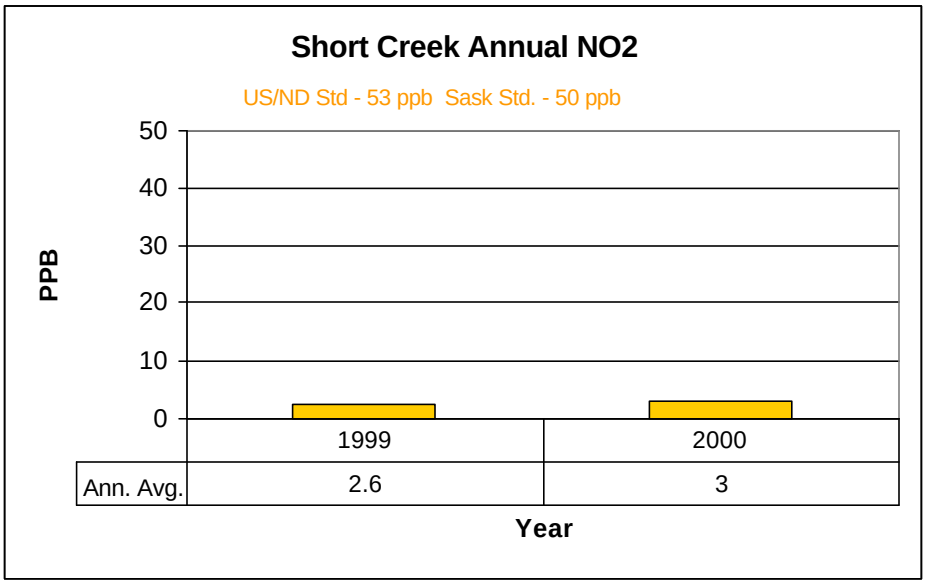

Figure 12 Annual Average Concentration of Nitrogen Dioxide at Short Creek, 1999-2000

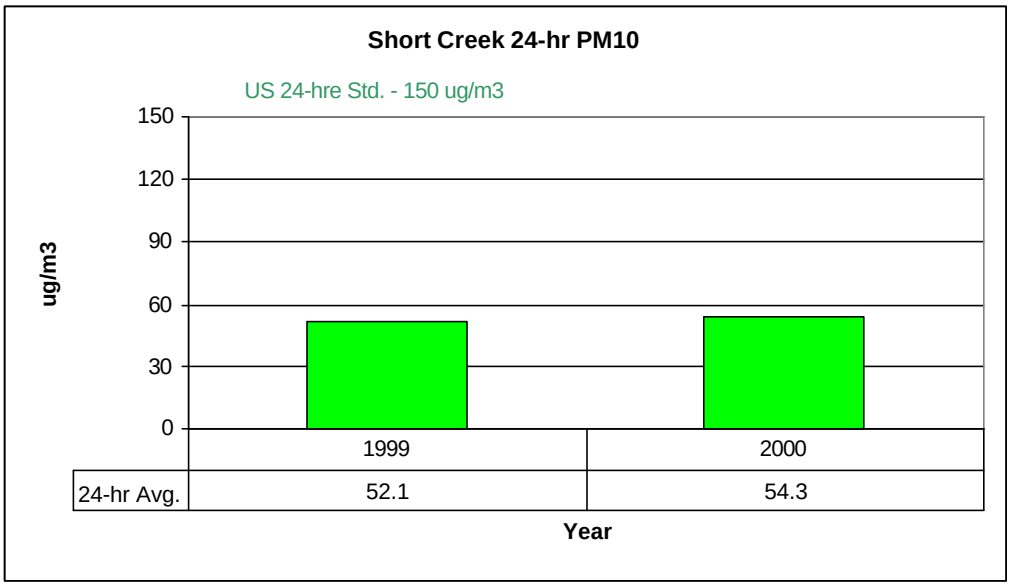

Figure 13 Maximum 24-h Concentration of PM10 at Short Creek, 1999-2000

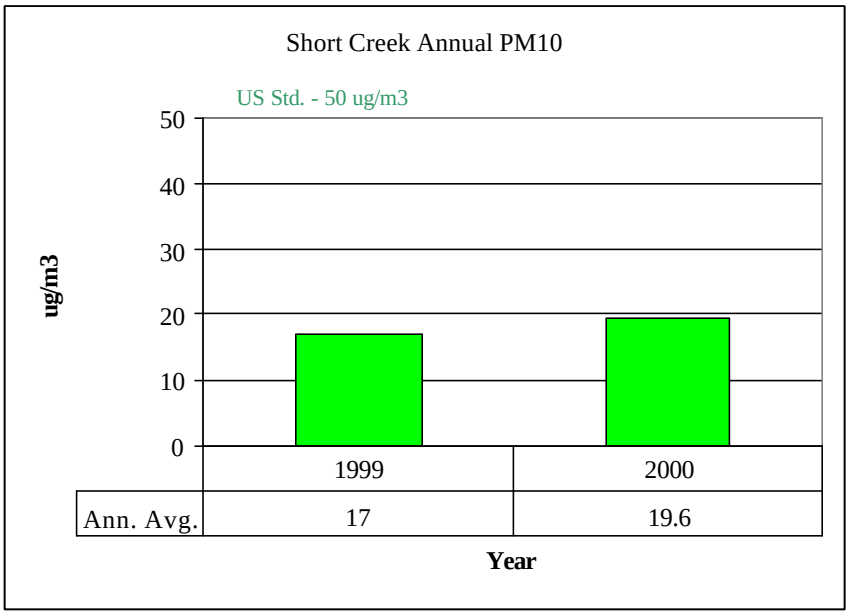

Figure 14 Annual Average Concentration of PM10 at Short Creek, 1999-2000

Appendices 1 to 4

Final Guidelines for Implementing the Consultation Process under Article XI of the United States–Canada Air Quality Agreement

Approved by the United States–Canada Air Quality Committee
1998 Annual Meeting

The general purpose of the Air Quality Agreement, as described in Article II, is to establish a practical and effective instrument to address shared concerns regarding transboundary air pollution. Article XI of the Agreement, concerning consultations, addresses this purpose and reads:

> *The Parties shall consult, at the request of either Party, on any matter within the scope of this Agreement. Such consultations shall commence as soon as practicable, but in any event not later than thirty days from the date of receipt of the request for consultations, unless otherwise agreed by the Parties.*

The purpose of this document is to propose a process for implementing the Consultation Process pursuant to Article XI. While the immediate goal of the proposed process is to provide a way to respond to a concern regarding possible transboundary air pollution, an important benefit of the process is the binational working level relationships that the process engenders. It is the sustainable working level cooperation that can assist in preventing future calls on the Consultation provision in the Air Quality Agreement.

A consistent theme of the proposed consultation process is that people matter. People of both countries, working together, will provide the focus to keep the process moving forward, investigate the problems of concern and identify potential solutions. The following four-step process must be viewed as flexible and should be tailored to each situation:

[1] Concerned Party Identifies Problem and Initiates Consultation Process. The consultation process will begin when the concerned party defines the problem of concern and requests that the consultation process be initiated. The official initiation of the consultation process should be by letter from the Subcommittee I co-chair of one country to the Subcommittee I co-chair of the other country. The problem or concern should be defined with as much specificity as possible to allow the respondent Party to adequately identify and investigate the problem. This will also allow the respondent Party to allocate the resources and staff appropriate for the investigation.

[2] Respondent Party Reports Initial Information The Party, whose territory includes the source of concern, should report initial information they may have or can quickly ascertain related to the problem of concern. This information may include such things as technical information on source, pollutants, transport, compliance with regulations, and regulatory framework.

At that time, it may be helpful to set up a series of regular conference calls between the Parties, including appropriate stakeholders if appropriate. This may include provinces, states, Indian tribes, cities, counties and industry. This is intended to improve the exchange of information and build a sense of co-operative consultation as well as to further the investigation and reveal new information.

[3] Face-to-Face Meetings

The next step may be to have a face-to-face meeting in the geographic area of the source or problem of concern. This should take place after the Parties have had a chance to understand and evaluate the technical information, circumstances, and regulatory framework surrounding the problem of concern. The purpose of this meeting would be to increase knowledge through binational teamwork.

[4] Feedback to Concerned Citizens, Stakeholders, the Public, the Air Quality Committee

The final step would be to provide feedback to the public and interested citizens. This may include provinces, states, Indian tribes, cities, counties, and others, as well as the Air Quality Committee. The feedback should include analysis of the problem of concern and potential solutions if warranted. Finally, the feedback should include an assessment of opportunities to maintain and support a continuing relationship at the working level.

Appendix 2

Member Organizations of the Consultation Group

The Saskatchewan–North Dakota Transboundary Consultation Group

Member Name	Agency
Chuck Bosgoed	Saskatchewan Environment
Kim Hallard	Saskatchewan Environment
Terry Hanley	Saskatchewan Environment
Chris Gray	Saskatchewan Environment
Dave Smith	SaskPower
Robert Stedwill	SaskPower
Steve Podwin	SaskPower
Dale Evarts	USEPA Headquarters
Gordon MacRae	USEPA – Region 8
Terry O'Clair	Air Quality Division, North Dakota Department of Health,
Dan Harman	Air Quality Division, North Dakota Department of Health,
Jane Barton	Transboundary Air Issues Branch, Environment Canada
Kerri Timoffee	Transboundary Air Issues Branch, Environment Canada
Rod Frith	Prairie & Northern Region, Environment Canada
Dave Munro	Prairie & Northern Region, Environment Canada
Donald Rose	Oil, Gas & Energy Division, Environment Canada
Geoff Ross	Oil, Gas & Energy Division, Environment Canada
Jim Mar	Environmental Technology Centre, Environment Canada
Bill Hume	Prairie & Northern Region, Environment Canada

Corresponding Member

Randy Angle	Alberta Environment

Appendix 3

Regional Emissions Inventory

Sulfur Dioxide

Source	City	Country	Emissions Rate (tons/year)	Emissions Rate (tonnes/year)	Emissions Year
Amerada Hess - Tioga Gas plant	Tioga	US	1337	1213	2000
Bear Paw Energy - Grasslands Gas Plant	Sidney	US	805	730	2000
Bear Paw Energy - Lignite Gas Plant	Lignite	US	463	420	2000
Boundary Dam Power Station	Estevan	CAN	38183	34639	2000
Shand Power Station	Estevan	CAN	16079	14587	2000
Steelman Gas Plant	Steelman	CAN	7349	6667	1995
Bienfait Mine - Luscar	Bienfait	CAN	531	482	1995

Nitrogen Dioxide

Source	City	Country	Emissions Rate (tons/year)	Emissions Rate (tonnes/year)	Emissions Year
Amerada Hess - Tioga Gas Plant	Tioga	US	2480	2250	2000
Northern Border Pipeline - Compressor Station #4	Arnegard	US	167	152	2000
Bear Paw Energy - Alexander Compressor Station	Alexander	US	162	147	2000
Bear Paw Energy - Lignite Gas Plant	Sidney	US	133	121	2000
Amerada Hess - Cherry Creek	Arnegard	US	111	101	2000
Amerada Hess - Antelope #2 Compressor Station	Johnsons Corner	US	106	96	2000
Amerada Hess - Hawkeye Compressor Station	Charlton	US	100	91	2000
Boundary Dam Power Station	Estevan	CAN	18109	16428	2000
Shand Power Station	Estevan	CAN	6227	6087	2000
Bienfait Mine - Luscar	Bienfait	CAN	217	197	1995

Total Suspended Particulate Matter

Source	City	Country	Emissions Rate (tons/year)	Emissions Rate (tonnes/year)	Emissions Year
Boundary Dam Power Station	Estevan	CAN	91557	83060	2000
Shand Power Station	Estevan	CAN	283	257	2000
Bienfait Mine - Luscar	Bienfait	CAN	357	324	1995

PM10

Source	City	Country	Emissions Rate (tons/year)	Emissions Rate (tonnes/year)	Emissions Year
Boundary Dam Power Station	Estevan	CAN	33 568	30 453	2000
Shand Power Station	Estevan	CAN	104	94	2000
Bienfait Mine - Luscar	Bienfait	CAN	133	121	1995

PM2.5

Source	City	Country	Emissions Rate (tons/year)	Emissions Rate (tonnes/year)	Emissions Year
Boundary Dam Power Station	Estevan	CAN	9842	8929	2000

Conversion factor: 1 tonne = 1000 kg = 1.1023 ton (short)

Summary of Monitoring Results 1999–2000

COMPARISON OF AIR QUALITY DATA WITH THE AMBIENT AIR QUALITY STANDARDS *

POLLUTANT: SULFUR DIOXIDE (ppb)

LOCATION	YEAR	SAMPLING PERIOD	NUM OBS	MAXIMA 1 - HOUR 1ST MM/DD/HH	MAXIMA 1 - HOUR 2ND MM/DD/HH	MAXIMA 3 - HOUR 1ST MM/DD/HH	MAXIMA 3 - HOUR 2ND MM/DD/HH	MAXIMA 24 - HOUR 1ST MM/DD	MAXIMA 24 - HOUR 2ND MM/DD	ARITH MEAN	% >MDV
Short Creek - SPM	1999	FEB-DEC	7354	52 10/25/10	47 12/27/22	40 09/14/11	29 12/27/23	10 05/17	10 09/14	1.9	16.9
Short Creek - SPM	2000	JAN-DEC	8708	149 05/30/08	131 05/30/09	53 02/06/14	52 05/30/08	16 05/30	11 01/05	2.1	25.5

1999
 The maximum 1-hour concentration was 52 ppb at Short Creek - SPM on 10/25/10
 The maximum 3-hour concentration was 40 ppb at Short Creek - SPM on 09/14/11
 The maximum 24-hour concentration was 10 ppb at Short Creek - SPM on 05/17

2000
 The maximum 1-hour concentration was 149 ppb at Short Creek - SPM on 05/30/08
 The maximum 3-hour concentration was 53 ppb at Short Creek - SPM on 02/06/14
 The maximum 24-hour concentration was 16 ppb at Short Creek - SPM on 05/30

* The air quality standards are:

 ND STATE Standards -
    1) 273 ppb maximum 1-hour average concentration.
    2) 99 ppb maximum 24-hour average concentration.
    3) 23 ppb maximum annual arithmetic mean concentration.

  US FEDERAL Standards -
    1) 500 ppb maximum 3-hour concentration not to be exceeded more than once per year.
    2) 140 ppb maximum 24-hour concentration not to be exceeded more than once per year.
    3) 30 ppb annual arithmetic mean.

  Sask. Provincial Standards -
    1) 0.17 ppm maximum 1-hour average concentration.
    2) 0.06 ppm maximum 24-hour average concentration.
    3) 0.01 ppm annual arithmetic mean.

POLLUTANT: SO_2 5-Minute Averages (ppb)

LOCATION	YEAR	SAMPLING PERIOD	NUM OBS	5-MINUTE MAXIMA 1ST	DATE MM/DD/HH	2ND	DATE MM/DD/HH	3RD	DATE MM/DD/HH	% >MDV
Short Creek - SPM	1999	FEB-DEC	7354	172	03/01/13	135	03/02/13	130	03/01/12	25.4
Short Creek - SPM	2000	JAN-DEC	8708	381	05/30/08	365	05/30/09	193	02/06/12	35.0

1999 - The maximum 5-minute concentration was 172 ppb at Short Creek - SPM on 03/01/13
2000 - The maximum 5-minute concentration was 381 ppb at Short Creek - SPM on 05/30/08

* No Standard is currently in effect:

POLLUTANT: NITROGEN DIOXIDE (ppb)

LOCATION	YEAR	SAMPLING PERIOD	NUM OBS	MAXIMA 1-HOUR 1ST MM/DD/HH	2ND MM/DD/HH	ARITH MEAN	% >MDV
Short Creek - SPM	1999	FEB-DEC	7336	24 12/27/22	22 04/14/03	2.6	69.9
Short Creek - SPM	2000	JAN-DEC	8691	24 11/29/07	24 12/26/00	3.0	75.6

1999 - The maximum 1-hour concentration was 24 ppb at Short Creek - SPM on 12/27/22
2000 - The maximum 1-hour concentration was 24 ppb at Short Creek - SPM on 11/29/07

* The air quality standards are:

ND STATE - 53 ppb maximum annual arithmetic mean.
US FEDERAL - 53 ppb annual arithmetic mean.

Sask. Provincial Standards are:
1) 0.2 ppm maximum 1-hour average concentration.
2) 0.05 ppm annual arithmetic mean.

POLLUTANT: CONTINUOUS PM2.5 (µg/m^3)

				MAXIMA					
				1 - HOUR		24 - HOUR			
LOCATION	YEAR	SAMPLING PERIOD	NUM OBS	1ST MM/DD/HH	2ND MM/DD/HH	1ST MM/DD	2ND MM/DD	3RD MM/DD	4TH MM/DD	MEAN
Short Creek - SPM	2000	AUG-DEC	3112	33.9 10/18/17	29.6 10/21/19	14.8 10/12	13.8 08/24	11.1 08/26	9.5 08/25	3.1

2000
The maximum 1-hour concentration was 33.9 µg/m3 at Short Creek – SPM on 10/18/17
The highest 24-hour concentration was 14.8 µg/m3 at Short Creek – SPM on 10/12

* The ambient air quality standards are:

US FEDERAL Standards -
1) 24-hour: 3-year average of 98th percentiles not to exceed 65 µg/m^3.
2) Annual: 3-year average not to exceed 15 µg/m^3.

Canadian-Wide Standard -
24-hour: 3-year average of 98th percentiles not to exceed 30 µg/m^3.

POLLUTANT: FRM PM2.5 PARTICULATE (µg/m^3)

LOCATION	YEAR	SAMPLING PERIOD	NUM OBS	MIN	MAXIMA 1ST MM/DD	MAXIMA 2ND MM/DD	MAXIMA 3RD MM/DD	ARITH MEAN	% >MDV
Estevan, SK	2000	NOV-DEC	7 ***	5.0	13.9 11/23	13.4 12/12	7.5 11/30	8.7	100.0
Lignite - SPM	1999	SEP-DEC	16	1.8	8.1 11/08	7.6 09/09	6.5 11/14	4.6	93.7
Lignite - SPM	2000	JAN-DEC	56	1.5	12.8 08/04	12.7 02/12	12.2 02/24	5.9	98.2
Rafferty Dam, SK	2000	APR-DEC	40	2.0	13.9 08/04	12.9 08/10	11.8 12/14	6.2	100.0
Short Creek - SPM	1999	APR-DEC	35	2.1	21.8 10/27	10.5 08/04	9.7 05/01	6.2	100.0
Short Creek - SPM	2000	JAN-DEC	60	1.5	13.3 08/04	11.8 02/06	11.8 02/24	5.8	98.3

1999 - The maximum 24-hour concentration was 21.8 µg/m^3 at Short Creek - SPM on 10/27
2000 - The maximum 24-hour concentration was 13.9 µg/m^3 at Estevan, SK on 11/23 and at Rafferty Dam, SK on 08/04

* The ambient air quality standards are:

US FEDERAL Standards -
1) 24-hour: 3-year average of 98th percentiles not to exceed 65 µg/m^3.
2) Annual: 3-year average not to exceed 15 µg/m^3.

Canadian-Wide Standard -
24-hour: 3-year average of 98th percentiles not to exceed 30 µg/m^3.

*** Less than 80% of the possible samples (data) were collected.

POLLUTANT: INHALABLE PM10 PARTICULATE (µg/m^3)

LOCATION	YEAR	SAMPLING PERIOD	NUM OBS	MIN	MAXIMA 1ST MM/DD	MAXIMA 2ND MM/DD	MAXIMA 3RD MM/DD	ARITH MEAN	% >MDV
Short Creek - SPM	1999	JAN-DEC	56	5.2	52.1 08/04	44.6 07/29	42.2 10/21	17.0	100.0
Short Creek - SPM	2000	JAN-DEC	57	2.4	54.3 05/30	48.8 08/22	48.0 03/07	19.6	98.2

1999 - The maximum 24-hour concentration was 52.1 µg/m^3 at Short Creek - SPM on 08/04
2000 - The maximum 24-hour concentration was 54.3 µg/m^3 at Short Creek - SPM on 05/30

* The STATE and FEDERAL air quality standards are:
   1) 150 µg/m^3 maximum averaged over a 24-hour period with no more than one expected excursion per year.
   2) 50 µg/m^3 expected annual arithmetic mean.

POLLUTANT: PM10 SULFATE (µg/m^3)

LOCATION	YEAR	SAMPLING PERIOD	NUM OBS	MIN	MAXIMA 1ST MM/DD	MAXIMA 2ND MM/DD	MAXIMA 3RD MM/DD	ARITH MEAN	% >MDV
Short Creek - SPM	1999	JAN-DEC	56	0.3	5.7 04/30	5.5 03/13	5.2 03/07	1.3	92.8
Short Creek - SPM	2000	JAN-DEC	57	0.2	3.3 03/07	3.1 03/13	3.1 08/04	1.3	85.9

1999 - The maximum 24-hour concentration was 5.7 µg/m^3 at Short Creek - SPM on 04/30
2000 - The maximum 24-hour concentration was 3.3 µg/m^3 at Short Creek - SPM on 03/07

* No standard is currently in effect.